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| APPLICATION NO.  | FILING DATE | FIRST NAMED INVENTOR   | ATTORNEY DOCKET NO.            | CONFIRMATION NO. |
|--|-------------|------------------------|--------------------------------|------------------|
| 10/809,276   | 03/25/2004  | Prabhakaran K. Centala | 05516/148002                   | 6042             |
| 7590<br>Jonathan P. Osha<br>OSHA & MAY L.L.P.<br>Suite 2800<br>1221 McKinney Street<br>Houston, TX 77010 |             | 03/26/2007             | EXAMINER<br>FERRIS III, FRED O |                  |
|  |             |                        | ART UNIT<br>2128               | PAPER NUMBER     |
| SHORTENED STATUTORY PERIOD OF RESPONSE   |             | MAIL DATE              | DELIVERY MODE                  |                  |
| 3 MONTHS   |             | 03/26/2007             | PAPER                          |                  |

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

|                              |                        |                     |  |
|------------------------------|------------------------|---------------------|--|
| <b>Office Action Summary</b> | <b>Application No.</b> | <b>Applicant(s)</b> |  |
|                              | 10/809,276             | CENTALA ET AL.      |  |
|                              | <b>Examiner</b>        | <b>Art Unit</b>     |  |
|                              | Fred Ferris            | 2128                |  |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) Responsive to communication(s) filed on 29 June 2004.
- 2a) This action is **FINAL**.                    2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) Claim(s) 2-23,25-38,40,42,43 and 45-48 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) Claim(s) \_\_\_\_\_ is/are allowed.
- 6) Claim(s) 2-23,25-38,40,42,43 and 45-48 is/are rejected.
- 7) Claim(s) \_\_\_\_\_ is/are objected to.
- 8) Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on 2 August 2004 is/are: a) accepted or b) objected to by the Examiner.  
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) All    b) Some \* c) None of:
  1. Certified copies of the priority documents have been received.
  2. Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- 1) Notice of References Cited (PTO-892)
- 2) Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) Information Disclosure Statement(s) (PTO/SB/08)  
 Paper No(s)/Mail Date 5/2,9/7.
- 4) Interview Summary (PTO-413)  
 Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) Notice of Informal Patent Application
- 6) Other: \_\_\_\_\_.

**DETAILED ACTION**

1. *Claims 1-48 have been presented for examination based on applicant's preliminary amendment of 29 June 2004 and disclosure filed 4 February 2004. Claims 1, 24, 39, 41, and 44 have been canceled. Claims 2-23, 25-38, 40, 42-43, and 45-48 remain pending in this application and stand rejected by the examiner.*

**Drawings**

2. *The drawings are objected to because Figures 9A – 9C are of poor quality and difficult to read. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.*

### ***Double Patenting***

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

***3. Claims 2-23, 25-38, 40, 42-43, and 45-48 are rejected on the grounds of nonstatutory obviousness type double patenting as being unpatentable over claims 1-14 of U.S. Patent No. 6,785,641.***

*Although the conflicting claims are not identical, they are not patentably distinct from each other because:*

*Independent claims 45-48 include limitations relating to designing a drill bit by simulating drilling, selecting parameters, determining radial (lateral) forces, and adjusting parameters as a subset of certain limitations in claims 1-14 of U.S. Patent 6,785,641. Specifically, claims 45-48 appear to "read on" the combined limitations of*

*the invention as claimed in claims 1-14 of U.S. 6,785,641. Subsequent dependent claims of the present invention appear to be recited as subsets of dependent claims 2-14 of U.S. Patent 6,785,641.*

**4. Claims 2-23, 25-38, 40, 42-43, and 45-48 are further rejected on the grounds of nonstatutory obviousness type double patenting as being unpatentable over claims 23-45 of U.S. Patent No. 6,516,293.**

*Although the conflicting claims are not identical, they are not patentably distinct from each other because:*

*Independent claims 45-48 include limitations relating to designing a drill bit by simulating drilling, selecting parameters, determining radial (lateral) forces, and adjusting parameters as a subset of certain limitations in claims 23-45 of U.S. Patent 6,516,293. Specifically, claims 45-48 appear to "read on" the combined limitations of the invention as claimed in claims 23-45 of U.S. 6,516,293. Subsequent dependent claims of the present invention are recited as subsets of dependent claims 24-45 of U.S. Patent 6,516,293.*

### ***Claim Rejections - 35 USC § 101***

*35 U.S.C. 101 reads as follows:*

*Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.*

**5. Claims 2-23, 25-38, 40, 42-43, and 45-48 are rejected under 35 U.S.C. 101 because the claimed invention is drawn to non-statutory subject matter.**

Per independent claims 45-48: The Examiner submits that, in view of the language of the claims, method claims 45-48 do not appear to recite a concrete and tangible result. The examiner submits that in order to establish a practical application, there must be either a physical transformation, or a useful, concrete and tangible result. Data transformation is not the same as a physical transformation. In this instance, there does not appear to be a concrete and tangible result. Here, the method steps for "designing drill bits" by "determining radial forces" only appears to result in a range of optimized parameters (numbers) resulting from the recited "adjusting". This is simply a mathematical computation resulting in an un-stored and un-applied number, not a physical transformation. The claimed "adjusting" of parameters based on an evaluation", in this case, is a thought or computation, and not in and of itself a concrete and tangible result. It is not until the result is applied in a meaningful way that it has real world value and becomes a concrete and tangible result. For example, there does not appear to be a concrete and tangible result that is specifically applied to achieve the drill bit design as recited in the preamble.

MPEP 2106 recites the following:

"A. Identify and Understand Any Practical Application Asserted for the Invention  
The claimed invention as a whole must accomplish a practical application. That is, it must produce a "useful, concrete and tangible result." State Street, 149 F.3d at 1373, 47 USPQ2d at 1601-02. The purpose of this requirement is to limit patent protection to inventions that possess a certain level of "real world" value, as opposed to subject matter that represents nothing more than an idea or concept, or is simply a starting point for future investigation or research (Brenner v. Manson, 383 U.S. 519, 528-36, 148 USPQ 689, 693-96); *In re Ziegler*, 992, F.2d 1197, 1200-03, 26 USPQ2d 1600, 1603-06 (Fed. Cir. 1993)). Accordingly, a complete disclosure should contain some indication of the practical application for the claimed invention, i.e., why the applicant believes the claimed invention is useful.

Apart from the utility requirement of 35 U.S.C. 101, usefulness under the patent eligibility standard requires significant functionality to be present to satisfy the useful result aspect of the practical application requirement. See *Arrhythmia*, 958 F.2d at 1057, 22 USPQ2d at 1036. Merely claiming nonfunctional descriptive material stored in a computer-

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*readable medium does not make the invention eligible for patenting. For example, a claim directed to a word processing file stored on a disk may satisfy the utility requirement of 35 U.S.C. 101 since the information stored may have some "real world" value. However, the mere fact that the claim may satisfy the utility requirement of 35 U.S.C. 101 does not mean that a useful result is achieved under the practical application requirement. The claimed invention as a whole must produce a "useful, concrete and tangible" result to have a practical application.*

*Although the courts have yet to define the terms useful, concrete, and tangible in the context of the practical application requirement for purposes of these guidelines, the following examples illustrate claimed inventions that have a practical application because they produce useful, concrete, and tangible result:*

- Claims drawn to a long-distance telephone billing process containing mathematical algorithms were held to be directed to patentable subject matter because "the claimed process applies the Boolean principle to produce a useful, concrete, tangible result without pre-empting other uses of the mathematical principle." AT & T Corp. v. Excel Communications, Inc., 172 F.3d 1352, 1358, 50 USPQ2d 1447, 1452 (Fed. Cir. 1999);*
- "[T]ransformation of data, representing discrete dollar amounts, by a machine through a series of mathematical calculations into a final share price, constitutes a practical application of a mathematical algorithm, formula, or calculation, because it produces a useful, concrete and tangible result" -- a final share price momentarily fixed for recording and reporting purposes and even accepted and relied upon by regulatory authorities and in subsequent trades." State Street, 149 F.3d at 1373, 47 USPQ2d at 1601; and*
- Claims drawn to a rasterizer for converting discrete waveform data samples into anti-aliased pixel illumination intensity data to be displayed on a display means were held to be directed to patentable subject matter since the claims defined "a specific machine to produce a useful, concrete, and tangible result." In re Alappat, 33 F.3d 1526, 1544, 31 USPQ2d 1545, 1557 (Fed. Cir. 1994).*

*In this case, independent claims 45-48 do not appear to yield a concrete and tangible result, since the result is merely a calculated numerical representation of parameters based on "determining radial forces" that is not specifically concretely stored, displayed, or used to complete the representative drill bit design as recited in the preamble. Dependent claims inherit the defects of the claims from which they depend.*

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the first paragraph of 35 U.S.C. 112:

*The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.*

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6. *Claims 42 and 43 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.*

*Specifically, dependent claims 42 and 43 further recite a drill bit and bottom hole assembly designed according to the preceding method. There appears to be no support in the specification for the process of producing an actual drill bit or bottom hole assembly apparatus.*

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. *The term "no more than about" in claims 11-13, is a relative term which renders the claim indefinite. The term "no more than about" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.*

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and

the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

**8. *Claims 2-7 and 45-48 are rejected under 35 U.S.C. 103(a) as being unpatentable over "The Operational Mechanics of The Rock Bit", Ma et al, Petroleum Industry Press, Copyright 1996.***

*The Ma reference is a study of the dynamics of the interaction between the roller cone drill bit and rock (earth) including bit geometry, kinematics, axial loading, and the balancing (equalization) of forces acting on a roller cone drill bit. In particular, Chapter 6, and to some degree Chapter 5, of Ma sets forth the elements of what he refers to as the "New Methodology" for roller cone bit design. This "New Methodology" includes the use of drilling simulation and computer modeling for optimizing the parameters relating to the design of new roller cone drill bits. (See: page 1, paragraph 2, for condensed overview).*

*The examiner submits that the teachings of Ma render obvious the claimed limitations of the instant invention as presently claimed as follows:*

*Regarding independent claim 45: A method for designing a drill bit, comprising:*

*- determining radial forces acting on a selected drill bit during simulated drilling; (6.1, 6.1.2.3, 5.3, 3.3 - 3.5, Ma discloses drilling simulation, forces acting on roller cones at least at pages 128, 129, section 5.1)*

*- evaluating the radial forces based on at least one selected criterion; (Ma teaches forces acting on roller cones at least at pages 128, 129, section 5.1, which would be an inherent part of optimizing the 3-D load model using finite element analysis disclosed in sections 6.1-6.2.3 of Ma. (especially, 6.1.1.5))*

- adjusting at least one parameter of the selected drill bit based on the evaluating; (6.1, 6.1.1.1, 6.1.2.3, page 232, lines 6-11, Ma sets forth adjusting design parameters)

Regarding independent claim 46: A method for designing a bottom hole assembly, comprising:

- determining radial forces acting on a bottom hole assembly during simulated drilling, said bottom hole assembly including a drill bit. (6.1, 6.1.2.3, 5.3, 3.3 - 3.5, Ma discloses drilling simulation, forces acting on roller cones at least at pages 128, 129, section 5.1, and a bottom pattern modeling at least in Figures 5-20 to 5-32)

- evaluating the radial forces based on at least one selected criterion; (Ma teaches forces acting on roller cones at least at pages 128, 129, section 5.1, which would be an inherent part of optimizing the 3-D load model using finite element analysis disclosed in sections 6.1-6.2.3 of Ma. (especially, 6.1.1.5))

- adjusting at least one parameter of the bottom hole assembly based on the evaluation (6.1, 6.1.1.1, 6.1.2.3, page 232, lines 6-11, Ma sets forth adjusting design parameters)

Regarding independent claim 47: A method for designing a bit, comprising:

- determining radial forces acting on a selected drill bit during a simulated drilling in selected earth formation; (6.1, 6.1.2.3, 5.3, 3.3 - 3.5, Ma discloses drilling simulation, forces acting on roller cones at least at pages 128, 129, section 5.1)

- graphically displaying the radial forces determined during the simulation; Ma teaches forces acting on roller cones at least at pages 128, 129, section 5.1. The ability to

*graphically display the results would have been a standard feature available on any computer system at the time of the invention, and hence would have knowingly been implemented by any skilled artisan tasked with realizing a drill simulation result on a digital computer system.*

- adjusting at least one parameter of the drill bit based on the graphical display of the radial forces. (6.1, 6.1.1.1, 6.1.2.3, page 232, lines 6-11, Ma sets forth adjusting design parameters)

Regarding independent claim 48: This claim merely requires a comparison of forces between a first and second bit simulation in selecting a preferred design using the same features noted above. This feature is rendered obvious by Ma since Ma discloses that simulations steps should be run “again and again” to achieve an optimum design (6.2.3, especially page 234, para:1). Hence a skilled artisan would have known to use multiple (first and second) simulations in determining a preferred design.

Hence, it would have been obvious to a skilled artisan having access to the teachings Ma at the time of the invention to realize the elements of the present invention as currently claimed. An obvious motivation exists since Ma teaches that the elements as claimed, and noted above, can be combined in order to find an optimum design and avoid bit (breakage) failure (chapter 6, section 5.4, especially page 232, based on the entire teaching).

Per claims 2-7: Ma renders obvious elements relating to performance parameters and cutting element interaction of a roller cone bit as noted above (6.1, 6.1.1.1, 6.1.2.3, page 232, lines 6-11)

**9. Claims 8 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable in further view of “Drag-Bit Performance Modeling, Warren et al, SPE Drilling Engineering, June 1989”**

Analogous art Warren renders obvious elements of the present invention relating to simulating the fixed cutter drill bit drilling an earth formation; (pp. 119, col. 1, para:3-7, pp. 126, col. 1, para:2 to col. 2, para:3, Fig. 6) and determining a cutter-formation interaction force, relative sliding velocity, and cutting surface parameters on a cutter of the fixed cutter drill bit (pp. 19, col. 1, para:6, 7, pp. 126, col. 1, para:2 to col. 2, para:3, Fig. 6, Fig. 6). Hence a skilled artisan would have knowingly modified the teachings of Ma with the teachings of Warren, motivated using the same reasoning as previously cited above, to implement a fixed cutter drill bit.

**10. Claims 10-23, and 25-35 are rejected under 35 U.S.C. 103(a) as being unpatentable in further view of U.S. Patent 6,695,073 issue to Glass et al.**

Regarding claims 10-23, and 25-35: This group of claims includes limitations relating to summing radial (lateral) forces and comparing the forces to an applied WoB to generate a ratio of the sum and forces. Analogous art Glass renders obvious these limitations by disclosing programmed calculations of summed orthogonal cutter forces

*inclusive of weight-on-bit. (CL4-L27-46) The recited box-whisker plot is simply a well-known convenient way of graphically depicting a number summary, which consists of the smallest observation, lower quartile, median, upper quartile, and largest observation (See: CRC, or Wikipedia, for example) and hence would have knowingly been implemented by a skilled artisan in order to graphically depict the summed forces.*

### ***Claim Rejections - 35 USC § 102***

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

**11. Claims 2-7, 40, 42, 43, and 45-48 are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent 6,412,577 issue to Chen.**

Regarding claims 2-6, 40, 42, 43, 45-48: Chen discloses drill bit design (fixed and roller, Figs. 11, 12) by simulating roller cone earth drilling including calculating roller cone element geometry (forces )and selecting drilling parameters (CL7-L26-29, Figs. 1A-C), and simulated earth formation drilling (CL9-L44, CL10-L2-15). Chen further discloses calculating forces on cutting elements (Abstract, CL7-L48-47, Fig. 1C, compressive forces: CL3-L52-67), simulating an incrementally rotating bit (CL7-L30-47), and recalculating cutting element forces based on design parameter to meet design criteria and optimizing performance (CL12-L25-28). Chen further discloses graphically displaying resulting design parameters (CL7-L29, 47, CL12-L25-41).

**Conclusion**

12. *The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.*

*"The Computer Simulation of the Interaction Between Roller Bit and Rock", Ma et al, SPE 29922, SPE 1995*

13. *Any inquiry concerning this communication or earlier communications from the examiner should be directed to Fred Ferris whose telephone number is 571-272-3778 and whose normal working hours are 8:30am to 5:00pm Monday to Friday. Any inquiry of a general nature relating to the status of this application should be directed to the group receptionist whose telephone number is 571-272-3700. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kamini Shah can be reached at 571-272-2279. The Official Fax Number is: (571) 273 8300.*

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